50 V/div
2 us/div
AVR-2B-B

- **Amplitudes to 50, 100, 200, 250, 300, or 400 Volts**
- **IEEE-488.2 GPIB and RS-232 interfaces**
- **Ethernet port for VXI-11.3 support**
- **10, 12.5, or 15 ns rise and fall times**
- **Pulse widths variable from 0.1 to 100 us**
- **PRF to 10, 20, or 100 kHz**
- **Peak powers up to 3.2 k**
- **Average powers up to 200W**
- **For time-of-flight and many other applications**

The AVR-1, -2, -3, and -4 models are high-voltage pulse generators capable of driving 50Ω (or higher) loads and operating over a wide pulse width range. The instruments include IEEE-488.2 GPIB, RS-232, and Ethernet interfaces. For diode loads, these models can be used to provide up to 1, 2, 4, 5, 6 or 8 Amps of pulsed current, if the diode is connected in series with 50Ω. These models operate over a wide pulse width range - typically 100 ns to 100 us.

Model AVR-1A-B provides amplitudes of up to 50 Volts with rise times of 10 ns. The pulse repetition frequency (PRF) is variable from 1 Hz to 100 kHz, provides average output powers up to 25 Watts and a maximum duty cycle of 50%.

Models AVR-2A-B and AVR-2B-B provide up to 100 Volts with rise times of 10 ns, and repetition rates up to 100 kHz. These models provide average output powers up to 50 and 100 Watts with maximum duty cycles of 25 and 50%, respectively. Higher power operation (160W, 80%) is optional on the AVR-2B-B.

The AVR-3-B provides up to 200 Volts with rise times of 10 ns. The PRF is variable from 1 Hz to 10 kHz. This model will provide peak output power of 800 Watts and average output power of 16 Watts (2% maximum duty cycle).

The AVR-3HE-B offers higher maximum PRF (to 100 kHz), higher duty cycles and average output powers (10% / 80W standard, 20% / 160W optional.)

The AVR-3HF-B offers higher amplitudes (up to 250V), and offers a standard maximum duty cycle and average power of 4% / 50W (optionally 8% / 100W or 16% / 200W).

The AVR-3HG-B provides up to 300V, with a standard maximum duty cycle and average power of 0.8% / 14W (optionally 3.3% / 59W or 6.6% / 118W).

The AVR-4-B provides up to 400 Volts out with rise times of 15 ns, and pulse widths variable from 100 ns to 100 us. The PRF is variable from 1 Hz to 10 kHz. This model will provide peak output power of 3.2 kW and a standard maximum duty cycle and average power of 4% / 50W (optionally 3.1% / 100W or 6.2% / 200W).

The MOSFET output stages in all models will safely withstand any combination of front panel control settings, output open or short circuits, and high-duty cycles. An internal power supply monitor removes the power to the output stage for five seconds if an average power overload exists. For example, the 200V AVR-3-B output stage will source up to 4A, and will automatically self-limit if the load current exceeds 8A, approximately. The other models act similarly.

Aside from the internal clock, these instruments can also be triggered by a single-pulse pushbutton or an external TTL-level trigger input. When triggered externally the output pulse width can be set to track the input trigger pulse width (PW$_{OUT}$ = PW$_{IN}$). A delay control and a sync output are provided for scope triggering. A gate input is also provided.

All models include a complete computer control interface (see http://www.avtechpulse.com/gpib). This provides GPIB and RS-232 computer-control, as well as front panel keypad and adjust knob control of the output pulse parameters. A large backlit LCD displays the output amplitude, polarity, frequency, pulse width, and delay.

A standard rear-panel Ethernet connector allows the instrument to be remotely controlled using the VXI-11.3, ssh, telnet, and web protocols. In particular, the VXI-11.3 features allows software like LabView to control an instrument using standard VISA communications drivers and network cabling, instead of using older-style GPIB cabling and GPIB controller cards. See http://www.avtechpulse.com/options/vxi for details.

All models are available with positive or negative outputs. A dual-polarity option is also available in most configurations. The polarity must be specified when ordering. The output polarity of units with the dual-polarity option can be controlled by the front-panel settings, or by computer commands.

Standard models have low output impedance (<2Ω). A switchable output impedance option with internally-switched attenuators (-LV option) is available, allowing the output impedance to be set to <2Ω or 50Ω. The Z$_{OUT}$ = 50Ω mode is useful for applications where a proper 50Ω termination at the load is impossible (for example, testing semiconductors in cryostats), as it provides 50Ω "back-matching" at the pulser end of the transmission line (absorbing reflections from the mismatched load). It is also useful when driving properly-matched 50Ω loads, because internal attenuators are switched in place automatically, allowing clean pulses with amplitudes as low as 1V to be generated. The maximum duty cycle is significantly reduced in the Z$_{OUT}$ = 50Ω mode, to limit the internal power dissipation. When operating with Z$_{OUT}$ = 50Ω into a 50Ω load, the maximum output voltage is reduced by a factor of two, due to the resistor-divider effect. (Maximum power & voltage are only available in the Z$_{OUT}$ < 2Ω mode.)

All models require 100 - 240 Volts, 50 - 60 Hz, and are mounted in a rugged all-metal 4" x 17" x 15" chassis.

LabView drivers for these instruments are available for download at http://www.avtechpulse.com/labview.

Models in the AVR series may be suitable for replacing obsolete models from the former Velonex Corporation in many applications.

Many aspects of these models can be modified or customized. In general, the average output power delivered to the load, and the power dissipated in any internal output impedance (if non-zero), are notable cost drivers.

Actual test waveforms from shipped units are available from the online data pages for each model, at:

- http://www.avtechpulse.com/medium/avr-2a/#testresults
- http://www.avtechpulse.com/medium/avr-2b/#testresults
- http://www.avtechpulse.com/medium/avr-3/#testresults
- http://www.avtechpulse.com/medium/avr-3hf/#testresults
- http://www.avtechpulse.com/medium/avr-4/#testresults

For higher-voltage applications, Avtech also offers the AVR-5B (500V), AVR-7B (700V), and AVR-8A (1000V) families.

The Avtech AVOZ-D series is based on the AVR series, but offers multiple identical outputs – ideal for production testing of attenuators and other devices.

Contact Avtech with your special requirement!

SPECIFICATIONS   AVR-1, -2, -3 & -4 SERIES

Model[1]:		AVR-1A-B	AVR-2A-B	AVR-2B-B	AVR-3-B	AVR-3HE-B	AVR-3HF-B	AVR-3HG-B	AVR-4-B
Amplitude (into ≥ 50Ω)[2,4,7]:		<2.5 to 50V	<5 to 100V		<10 to 200V	<10 to 200V	<10 to 250V	<15 to 300V	<20 to 400V
Maximum output current:		1A	2A		4A	4A	5A	6A	8A
Rise & fall times (20%-80%) into 50Ω:		≤ 10 ns						≤ 12.5 ns	≤ 15 ns
Pulse width (FWHM):		100 ns to 100 us				50 ns to 100 us	100 ns to 100 us	50 ns to 100 us	100 ns to 100 us
Maximum PRF:		100 kHz			10 kHz	100 kHz	100 kHz	20 kHz	10 kHz
Max. duty cycle and average output power (excludes Z_{OUT}=50Ω mode on -LV units)	Standard:	50%, 25W	25%, 25W	50%, 100W	2%, 16W	10%, 80W	4%, 50W	0.8%, 14W	0.5%, 16W
	-XP1 option:	N/A	N/A	N/A	N/A	N/A	8%, 100W	3.3%, 59W	3.1%, 100W
	-XP2 option:	N/A	N/A	80%, 160W	N/A	20%, 160W	16%, 200W	6.6%, 118W	6.2%, 200W
Max. duty cycle and average output power[6] for Z_{OUT}=50Ω mode on -LV units:		10%, 5W	2.5%, 5W	2.5%, 5W	0.625%, 5W	0.625%, 5W	0.4%, 5W	0.277%, 5W	0.156%, 5W
Polarity[3]:		Positive or negative or both (specify). Dual polarity not available with -XP2 option.							
Output Impedance (Z_{OUT}):		Standard units: < 2 Ω, approximately (i.e., nominally zero). With -LV option: <2Ω or 50Ω, switchable[7].							
Internally-switched output attenuators:		Standard units: none. With -LV option: internal attenuators are automatically switched in when operating in the Z_{OUT} = 50Ω mode. This permits the generation of amplitudes of < 1V into 50Ω loads. The maximum average output power (including power dissipated in Z_{OUT} and the attenuators) is limited to 5 Watts in the Z_{OUT} = 50Ω mode. This limits the maximum duty cycle, as noted above. (Higher average power ratings and duty cycles in this mode can be provided at additional cost and with some degradation of the rise and fall times. Contact Avtech with your special requirements.) The internal attenuators are not used in the Z_{OUT} < 2Ω mode, and the 5W limit does not apply in that mode.							
Propagation delay:		≤ 150 ns (Ext trig in to pulse out)							
Jitter:		± 100 ps ± 0.03% of sync delay (Ext trig in to pulse out)							
Trigger modes:		Internal trigger, external trigger (TTL level pulse, > 10 ns, 1 kΩ input impedance), front-panel "Single Pulse" pushbutton, or single pulse trigger via computer command. In the external trigger mode, the pulse width may be set by the instrument, or it may be set to track the input pulse width.							
Variable delay:		Sync to main out: 0 to 1.0 seconds, for all trigger modes (including external trigger).							
Sync output:		> +3 Volts, > 50 ns, will drive 50 Ohm loads							
Gated operation:		Synchronous or asynchronous, active high or low, switchable.							
Connectors:		Out, Trig, Sync, Gate: BNC							
GPIB & RS-232 control[1]:		Standard feature on all -B units.							
LabView drivers:		Available for download at http://www.avtechpulse.com/labview.							
Ethernet port, for remote control using VXI-11.3, ssh, telnet, & web:		Included. Recommended as a modern alternative to GPIB / RS-232. See http://www.avtechpulse.com/options/vxi for details.							
Settings resolution:		The resolution of the timing parameters (pulse width, delay, period) varies, but is always better than 0.15% of (|set value| + 20 ns). The amplitude resolution is < 0.1% of the maximum amplitude.							
Settings accuracy:		Typically ± 3% (plus ±1V or ± 2 ns) after 10 minute warmup. For high-accuracy applications requiring traceable calibration, verify the output parameters with a calibrated oscilloscope[5].							
Power requirements:		100 - 240 Volts, 50 - 60 Hz							
Dimensions:		100 mm x 430 mm x 375 mm (3.9" x 17" x 14.8")							
Chassis material:		Cast aluminum frame and handles, blue vinyl on aluminum cover plates							
Mounting:		Any. Add -R5 to the model number to add a rack-mount kit.							
Temperature range:		+5°C to +40°C							

1) -B suffix indicates IEEE-488.2 GPIB and RS-232 control of amplitude and frequency. See http://www.avtechpulse.com/gpib for details.
2) Lower amplitudes are possible with the -LV option, or by adding external attenuators.
3) Indicate desired polarity by suffixing model number with -P or -N (i.e. positive or negative), or -PN for dual polarity option.
4) The instrument may be used to drive resistive loads of less than 50 Ohms, as long as the maximum output current specification is not exceeded. The rise and fall times may increase.
5) These instruments are provided with a basic calibration checksheet, showing a selection of measured output parameters. These

measurements are performed with equipment that is calibrated on a regular basis by a third-party ISO/IEC 17025:2005 accredited calibration laboratory. However, Avtech itself does not claim any accreditation. For applications requiring traceable performance, use a calibrated measurement system rather than relying on the accuracy of the pulse generator settings.
6) Including the power dissipated in Z_{OUT} and internal attenuators.
7) Note that the maximum output voltage falls by a factor of 2 when Z_{OUT} = 50Ω (on units with the -LV option) *and* the load resistance = 50Ω, due to the resistor-divider effect.